PATENT ABSTRACTS OF JAPAN

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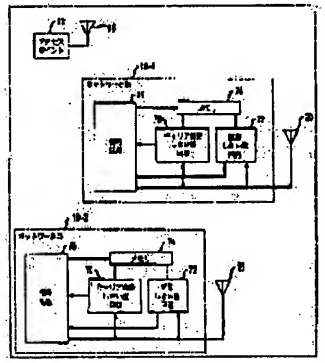
(54) RADIO LOCAL AREA NETWORK IMPROVED IN CARRIER DETECTION



(57)Abstract:

PROBLEM TO BE SOLVED: To avoid collision, to enhance the availability of a common channel medium and to reduce the powder consumption of a mobile station by allowing a network station to set suspension threshold that suspends the transmission for a data signal when a signal that exceeds threshold is received to higher sensitivity than carrier detection threshold that performs receiving processing when the signal that exceeds threshold is received.

SOLUTION: Mobile network stations 18 receive a signal on time slot base during a receiving mode and a carrier detection threshold circuit 70 and a suspension threshold circuit 72 decide the energy level of an incoming signal. When the circuit 72 detects a signal whose level exceeds threshold, it outputs a suspension instruction signal which notifies that sending can not be performed to prevent collision to a signal processing circuit 76. When a signal level increases and the circuit 70 detects a signal whose level exceeds threshold, it outputs a detection signal to the circuit 76 and the circuit 76 starts receiving processing.

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CLAIMS

[Claim(s)]
[Claim 1] It is the approach of operating a wireless local-area network station. This approach The phase of establishing a Carrier Detect threshold level, and the phase of establishing an adjournment threshold level, The phase of receiving the carrier signal which has corresponding power signal level, and the phase of transmitting a signal when this power signal level is lower than this adjournment threshold, The approach characterized by consisting of a phase of processing this carrier signal for these network stations when this power signal level is higher than this 1st Carrier Detect threshold level.
[Claim 2] It is the approach characterized by consisting of a phase where this approach changes this Carrier Detect threshold level and this adjournment threshold level further in an approach according to claim 1.
[Claim 3] It is the approach characterized by consisting of a phase where this approach establishes this Carrier Detect threshold level on level higher than this adjournment threshold level further in an approach according to claim 1.
[Claim 4] It is the approach characterized by consisting of a phase where this approach establishes this Carrier Detect threshold level on level almost equal to this adjournment threshold level further in an approach according to claim 1.
[Claim 5] It is the approach characterized by consisting of a phase where this approach establishes this Carrier Detect threshold on level lower than this adjournment threshold level further in an approach according to claim 1.
[Claim 6] This approach is an approach characterized by consisting of a phase which chooses Carrier Detect threshold signal level so that the communication link cel in which two or more migration network stations communicate with a predetermined base station inside further in an approach according to claim 1 may be defined.
[Claim 7] The phase of establishing this adjournment threshold level in an approach according to claim 6 is an approach characterized by consisting of a phase of establishing adjournment threshold signal level so that it may become almost equal to the power level in alignment with the power-distance curve of the station located in one periphery of this communication link cel in the distance mostly located in the opposite side of this communication link cel.
[Claim 8] The approach characterized by the size of this communication link cel being the function of this Carrier Detect threshold and this adjournment threshold in an approach according to claim 1.
[Claim 9] It is the wireless local-area network station which can transmit and receive a signal within a communication link cel. This network station It consists of a Carrier Detect threshold circuit constituted so that the carrier signal which has power signal level might be received. This Carrier Detect threshold circuit It is almost equal to the Carrier Detect threshold parameter with which this power signal level was specified, or is what generates a detection indication signal when larger than it. This network station consists of an adjournment threshold circuit constituted so that this carrier signal that has this power signal level might be received further. This adjournment threshold circuit Postpone and come, and it is, and is almost equal to a value parameter, or is the thing as which this power signal level was specified and which generates an adjournment indication signal when larger than it. This network station consists of a digital disposal circuit combined with this Carrier Detect circuit and this adjournment threshold circuit further. So that the signal with which this digital disposal circuit answered this Carrier Detect indication signal, and was received by this network station may be processed, this digital disposal circuit may answer this adjournment indication signal and transmission of the signal by this network station may be postponed The wireless local-area network station characterized by receiving this Carrier Detect indication signal and this adjournment indication signal.
[Claim 10] The network station characterized by this Carrier Detect threshold level and this adjournment threshold level being adjustable in a network station according to claim 9.
[Claim 11] The network station characterized by this Carrier Detect threshold level being higher than this adjournment threshold level in a network station according to

claim 10.
[Claim 12] The network station characterized by this Carrier Detect threshold level being almost equal to this adjournment threshold level in a network station according to claim 10.
[Claim 13] The network station characterized by this Carrier Detect threshold level being lower than this adjournment threshold level in a network station according to claim 10.
[Claim 14] The network station characterized by being almost equal to the power level in alignment with the power / distance curve of the station to which this adjournment threshold level is located in one periphery of this communication link cel in a network station according to claim 9 in the distance mostly located in the opposite side of this communication link cel.
[Claim 15] The network station characterized by the size of this communication link cel being the function of this Carrier Detect threshold and this adjournment threshold in a network station according to claim 9.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to use of the extended media-access-control function to use at least two signal level thresholds for a detail, about a wireless data telecommunication system.
[0002]
[Background of the Invention] Current marketing of the wireless local area network is developed and carried out in order to avoid the need for the cable cable splicing between the stations of a local area network (Local Area Network:LAN). Such a wireless local area network uses two or more migration network stations which are the data processors (personal computer etc.) which have radio capacity.
[0003] In the network by the cable, collision detection can be attained comparatively easily. However, in the case of the network by the wireless which uses one channel, since the dynamic range of a received signal level is large, it is quite difficult [it] to detect a collision. Therefore, a wireless local area network usually uses a collision-avoidance scheme instead of collision detection.
[0004] The wireless local area network (LAN) is constituted based on the media-access-control (MAC) method using a scheme like CSMA/CA (carrier Chita pile access accompanied by collision avoidance) currently explained by IEEE802.11 specification generally "is heard before talking (listen-before-talk)." According to one example explained by IEEE802.11 specification, the access point which functions as a base station, and two or more of other network stations are contained in a wireless local area network. The network station in a group or a cel communicates with those corresponding access points directly. This access point transmits a message to the destination station in the same cel, or transmits it to other access points through a cable distribution system, and, finally a message is transmitted to a desirable destination station from there.
[0005] According to the media-access-control (MAC) method, if each local-area network station judges that other stations have not transmitted signal transmission, it will start transmission. For this reason, each station postpones transmission of a signal, as long as it is higher than the receiving threshold level as which the signal level received from other stations was specified. That is, it prevents that a media-access-control (MAC) method starts the signal transmission in which the 2nd game which separates from the 1st game and is located overlaps the transmission started by the 1st game before and a time amount target. Usually, the 2nd game postpones the period signal transmission chosen at random.
[0006] The Carrier Detect turn around time (carrier ditectiontunaround time) of a very short period is fundamental for this random standby property. For example, IEEE802.11 DSSS (Direct Sequence Spread Spectrum:DSSS (direct sequence diffuse spectrum)) specification needs the slot-ized random standby behavior based on the 20-microsecond (microsecond) time slot for Carrier Detect turn around time.
[0007] Furthermore, the media access control (Medium Access Control:MAC) explained by IEEE802.11 specification needs one signal threshold level to the two

modes, reception and adjournment. The minimum level of a receiving threshold is also the level used for adjournment. Therefore, a receiver suspends transmission, when exceeding a receiving threshold and detecting the signal of an and also [it is of some kind]. IEEE802.11 DSSS Specification is [at −70dBm, the transmitted power 50, or 100mW] equal to −80dBm with less than 50mW of transmitted power −76dBm and 100mW of transmitted power, and 1W, or specifies from it the adjournment threshold which must be high sensitivity.

[0008] Reference of drawing 1 shows and explains the approach of the conventional technique of offering collision avoidance. That is, IEEE802.11 CSMA / CA protocol is designed so that the collision possibility between the stations of a large number which access a medium at the point which is the easiest to generate may be reduced. The possibility of a collision becomes [be / it / under / use / of a medium / continuation] the highest at the time immediately after a medium will be in idle status. This is because many stations were waiting for a medium to become available again. Therefore, in order to solve contention contention of a medium, a random back-off method is used. Super-short period of time Carrier Detect turn around time is fundamental to those who became skillful in this work technical field for this random standby property so that clearly. Furthermore, IEEE802.11 media access control (MAC) defines the option about medium reservation by the point coordinate of a RTS/CTS (Rrequest-To-Sender/Clear-To-Send: Request-to-Send/ready for sending) polling dialogue and time amount limited service. As shown in drawing 1 , after during the medium use middle, all wireless LAN equipments must stand by during the so-called inter-frame spacing (Inter Frame Spacing:IFS) period, and as long as there is no transmission of after that others, after a required random number carries out slot time standby, they can try transmission.

[0009] the reuse of a common channel medium — being related — IEEE802.11 DSSS although specification specifies a permissible prehension property — this — more — low — use of a sensibility adjournment threshold is enabled and it concludes in better medium reuse conditions. However, that an adjournment threshold becomes low sensibility more means that the range where breakage of transmission is prevented becomes small. In the network of the access point base, and the extraordinary network by the server station, traffic goes an access point or a server station in and out. The minimum receiving level which an access point / server station, and its assigned station receive mutually is difficult to predict because of [for multi-pass phasing and a shadow effect] change of the distance of the migration network station from an access point.

[0010] Therefore, in consideration of receiving well by the low, the improved need for medium access equipment of offering common channel medium reuse high enough and power consumption low enough exists.

[0011]

[Summary of the Invention] This invention offers the media-access-control (MAC) method each station of whose in a local area network improved by using two variable parameters. One parameter is called the Carrier Detect threshold for receiving a desirable signal. A Carrier Detect threshold is the level of the carrier signal with which a network station does not tend to deal with a data signal and which is observed in a value lower than it. For example, by changing a Carrier Detect threshold, if it is exceeded, a signal is able to choose the signal level received and processed. The 2nd parameter is called an adjournment threshold. An adjournment threshold is the level of the carrier signal with which a network station postpones transmission of a data signal and which is observed, when it is exceeded.

[0012] Since according to one example of this invention an adjournment threshold is constituted so that it may become high sensitivity from a Carrier Detect threshold, all the stations that wish transmission of a data signal postpone signal transmission, as long as there are other network stations or access points which transmit a data signal. The required prehension ratio for the desirable cell size of a wireless local area network and good reception is a part of parameter which determines the parameter of a Carrier Detect threshold and an adjournment threshold. A medium reuse becomes good, so that the sensibility of an adjournment threshold is low. The capacity which covers a long distance by low traffic reinforcement is combinable with optimization of a set network throughput by choosing suitable adjournment and a Carrier Detect threshold by this approach.

[0013] desirable — being alike — according to one example of this invention, the same adjournment threshold is used about all stations including the access point where the cel range corresponds.

[0014] However, since a Carrier Detect threshold is alternatively changed about each station, please understand an advantageous thing. if another word is carried out and a Carrier Detect threshold will be high sensitivity — a transmitter-receiver chip — a Carrier Detect threshold — low — it will process more frequently than the case, sensibility. Since the low sensibility Carrier Detect threshold is taking into consideration reduction of the power consumption of a dc-battery, it is advantageous, but this is important for the migration network station which operates with a dc-battery so that clearly [those who became skillful in this work technical field].

[0015] Although this invention is explained below, referring to an attached drawing, this is only a thing as mere instantiation.

[0016]

[Detailed description of invention] Reference of drawing 2 shows the desirable example of the wireless local area network (LAN) 10 by which this invention is realized. The access point 12 which functions as having explained above as a base station is included in a local area network 10. However, this invention is not restricted at this point and can use the local area network using the server office which sends and receives a message to a network station of other classes. An access point 12 is connected with other equipments and/or network where the network station in LAN10 can communicate. In an access point 12, the antenna 16 constituted so that a communication channel might be led and a data signal might be transmitted and received is contained.

[0017] The mobile station 18-1 which has an antenna 20 respectively, and a migration network station 18 called 18-2 are contained in a network 10 again. Although a direct sequence diffuse-spectrum (DSSS) modulation can be used for a mobile station and a message can be alternatively transmitted and received by 1 Mbit/s (megabits per second) or 2 Mbit/s, this invention is not restricted to that range at this point. The Carrier Detect threshold circuit 70 and the adjournment threshold circuit 72 which can receive a signal via an antenna 20 are included in each mobile station 18. Memory 74 is constituted so that come, it may be [it may expect a Carrier Detect threshold parameter and a total,] and the numeric value of a value parameter may be saved. The output port of memory 74 is combined with the input port of the Carrier Detect threshold circuit 70. Similarly, another output port of memory 74 is combined with the input port of the adjournment threshold circuit 72. That is, memory 74 provides the Carrier Detect threshold circuit 70 corresponding to a desirable Carrier Detect threshold parameter with a signal. Memory 74 provides the desirable adjournment threshold circuit 72 corresponding to [postpone and come, are and] a value parameter with a signal similarly.

[0018] The digital disposal circuit 76 constituted so that the signal received by the antenna 20 might be processed further is contained in the migration network station 18. A digital disposal circuit 76 also processes the signal transmitted by the migration network station with an antenna 20 again. The input port of a digital disposal circuit 76 is constituted so that a detection indication signal may be received from the output port of the Carrier Detect threshold circuit 70. Similarly, another input port of a digital disposal circuit 76 is constituted so that an adjournment indication signal may be received from the output port of the adjournment threshold circuit 72. Since the output port of a digital disposal circuit 76 is combined with the input port of memory 74, it can postpone with the Carrier Detect threshold parameter saved in memory 74, and can be [can come,], and the numeric value of a value parameter can be changed.

[0019] According to one example of this invention, although each migration network station 18 receives a data signal with the time-slot base between the signal receive modes, this invention is not restricted to that range at this point. A Carrier Detect threshold circuit and an adjournment threshold circuit judge the energy level of a terminating signal during the time-slot period of 20 microseconds. The Carrier Detect threshold circuit 70 supervises the incoming-data signal received by the antenna 20. If the carrier signal exceeding a Carrier Detect threshold parameter of an energy level is detected, the Carrier Detect threshold circuit 70 will provide a digital disposal circuit 76 with a detection indication signal. Answering it, a digital disposal circuit 76 starts processing of the signal received by the antenna 20. Also when the energy level of the received signal postpones, comes and is and exceeds a value parameter, the adjournment threshold circuit 72 provides a digital disposal circuit 76 with the adjournment indication signal which tells a migration network station about the ability not to transmit, in order to avoid the collision on the communication channel used by the local area network 10.

[0020] Reference of drawing 3 shows the situation of the isolated cel from a viewpoint of an access point 12. The carrier signal level observed by the migration network station which separates from an access point 12 and is located is shown by the curve 29 as a function of the distance of the network station from an access point. A curve 29 is determined by the path loss property of the transmitted power used in an access point, and this environment. The capacity of the receiver of the station in the isolated cel is determined by Carrier Detect threshold like the Carrier Detect threshold shown by a straight line 32-1 or 32-2. As reference was made before, a Carrier Detect threshold level is defined by the value lower than it as the LAN station 18-1 and carrier signal level to which 18-2 does not process an incoming-data signal. The Carrier Detect threshold level 32-2 is distance so that it may be illustrated. - Intersecting a curve 29 by R2 and +R2, the Carrier Detect threshold level 32-1 is distance. - A curve 29 is intersected by R and +R. The distance to which the straight line of a Carrier Detect threshold level intersects the curve of carrier signal level determines the boundary of a local area network cel where a migration network station can communicate with an access point 12.

[0021] If the Carrier Detect threshold 32-1 becomes high sensitivity more lower so

that clearly, actuation and reception in the larger range will be attained. The cel produced as a result of using the Carrier Detect threshold level 32-1 is shown as a cel 28. The cel which similarly is produced as a result of using the Carrier Detect threshold 32-2 is shown as a cel 30. The network station which operates with the Carrier Detect threshold 32-2 is understood that sensibility is lower than the network station which operates by the Carrier Detect threshold level 32-1.

[0022] A range of number significant for a Carrier Detect threshold level has a low boundary rather than it is determined by the sensibility of a receiving circuit. For example, if a Carrier Detect threshold is set as a low numeric value, the attempt of much meaningless reception will be performed and it will conclude in the high rate of failure on parenchyma. more — low — by using a sensibility Carrier Detect threshold parameter, a local-area network-of-network office can operate within smaller cell size. in case such small cell size takes the possibility of the reuse of the same channel into consideration in the comparatively small range, it is desirable — it comes out. On the contrary, in a lower high sensitivity Carrier Detect threshold level, it can operate in the larger range.

[0023] Reference of drawing 4 shows the relation with a desirable Carrier Detect threshold level shown according to one example of this invention as the adjournment threshold level shown as a straight line 38, and a straight line 32-2. Although the situation that an adjournment threshold is set as level lower (high sensitivity) than a Carrier Detect threshold is shown by drawing 4 , this invention is not restricted to that range at this point. For example, according to other examples of this invention, a Carrier Detect threshold and an adjournment threshold may be changed so that they may attain the same level on parenchyma or a Carrier Detect threshold may become lower than an adjournment threshold.

[0024] According to one example of this invention, in order to determine the adjournment threshold to a predetermined Carrier Detect threshold, it must be taken up in distance R2 and the curve 33 corresponding to the carrier signal power must be plotted for an office called 40 of one side face of a cel as a function of the distance from an office 40. That is, a curve 33 shows the graph of level which is too called a carrier signal curve and with which the carrier signal received from the station 40 as a function of distance was observed. In the case of this example of this invention (+R2 [for example,]), the level which a curve 33 intersects on another side face of a cel defines the adjournment threshold level identified as a straight line 38.

[0025] Therefore, when there is transmission from an access point 12, the level which which station of the range of gray answers is over the Carrier Detect threshold level 32-2. That is, all stations only receive what is transmitted in a circle or cell size 30. However, if the level is exceeded, the level of the carrier signal with which each station postpones transmission and which is observed will be set up by the adjournment threshold level 38.

[0026] the media-access-control equipment shown by drawing 4 — being the so-called — hiding — terminal problem (hidden terminal problem) It removes on parenchyma. It hides, and a terminal problem is generated when two terminals which cannot be observed transmit a message to the 3rd terminal like an access point at coincidence. At this 3rd terminal like an access point 12, two signals interfere mutually and common channel interference is generated. As for the 3rd terminal, receiving one of the two messages loses two messages at the sacrifice of as hard as possible and precious bandwidth in many cases.

[0027] However, if the media-access-control equipment of drawing 4 is used, the office in one periphery of a cel will be postponed for the office of another most distant periphery of a cel. As explained above, this plots the curve about one periphery station, and when making it adjournment level certainly intersect this curve in other cel peripheries, it is attained. By choosing this level, all stations wait for and postpone each other, and the local area network to which each station communicates with an access point 12 is offered. Consequently, it hides in the group of the station belonging to a cel, and a terminal problem is removed on parenchyma.

[0028] The range of an adjournment threshold has the low boundary determined with the sensibility of a Carrier Detect circuit. When lower than a certain level, a signal is not detected and adjournment is not performed. The desirable relation shown in drawing 4 cannot be attained when set as the lowest high sensitivity level in which the Carrier Detect threshold 32-2 is possible. In this case, the lowest significant adjournment threshold does not guarantee the required adjournment between two "a periphery and offices" as shown in drawing 5 .

[0029] Selection of the numeric value of a low Carrier Detect threshold forms the big cell size of a radius R34, as shown in drawing 5 . When the lowest significant adjournment is plotted, the range which mutual adjournment generates has the small size shown in the small circle which has a radius R36. If this combination of a threshold is used, a network station can hide using the channel access equipment called a Request to Send / ready-for-sending (RTS/CTS) medium reservation device, and can avoid an office phenomenon on parenchyma. Apply this channel access equipment to the publication of this specification by citation. R. O.La Maire, A.Krishna, and P.Bhagwat, J. — Panian — "— wireless LAN and migration networking: —

specification and future direction (Wireless LANs and Mobile Networking:Standards and Future Direction)" — It is explained more to the detail by (the U.S. electrical-and-electric-equipment Institute of Electronics and Communication Engineers communication link magazine (IEEE Communication Magazine), Vol.34, No.8 (August, 1996), the 86th page, or the 94th page).

[0030] Reference of drawing 5 calls the sum total cel range 60 the basic coverage range (Basic Coverage Area:BCA). When this vocabulary is used, the range 62 of the smaller one is called the common coverage range (Shared Coverage Area:SCA), and it is shown in this range that the medium common regulation by this invention is effective. With desirable equipment, the common coverage range SCA is almost equal to the basic coverage range BCA.

[0031] When forming the cellular infrastructure system which has the threshold which the above for control of a low receiver and a transmitter defined, it is clear to those who became skillful in this work technical field that suitable balance with a roaming threshold should be maintained so that it may discuss below. When opting for transmission/receiving behavior of the station and access point where the Carrier Detect threshold 32-2 and the adjournment threshold 38 belong to the same cel, a roaming threshold level determines the moment a migration network station opts for initiation or a halt of the participation to a cel. A network station should care about setting capacity of the receiver by which a current setup was carried out as the foundation of the hand-over decision. That is, when small cell size is required, a roaming threshold must be set up so that retrieval of a new access point may be started before the time of it becoming impossible physically for a receiver to receive a message from the present access point.

[0032] Furthermore, according to the principle of this invention, it is possible to define the variable cell size which leads to the capacity which controls the consistency of the cel which covers a certain range directly, or an access point. If it pulls, it means a better sum total throughput from that of the same channel that many small cels are in a certain range as many reuses, rather than there is a small number of big cel.

[0033] In order to set up a Carrier Detect threshold and an adjournment threshold, according to this invention, by using an adjustable threshold, it is possible to reduce cell size and to increase the reuse of the same frequency in a certain range. One approach which reduces cell size is reducing the transmitted power of each access point. Since another approach raises the layer of Carrier Detect and an adjournment threshold according to the example as instantiation of this invention discussed above, it is advantageous. That is, each station disregards the signal of the cel range and tries most for it in order that it may be cautious of the signal for each stations. Furthermore, since cell size is small, if it gets to know that the purpose receiver is within the limits of a small cel, each station will be tried so that a signal may be transmitted without postponing.

[0034] This invention is realized in the condition machine of a MAC control unit. A condition machine transmitter-receiver is used, and when the effective modem carrier signal of the receiving level exceeding a Carrier Detect threshold is detected, a transmitter-receiver considers that this is an effective modem carrier signal, and starts reception. When the receiving level of an effective modem signal exceeds an adjournment threshold, a transmitter-receiver reports that a medium is using it to a MAC control unit by activating a control line signal.

[0035] The example explained here [a desirable example and here / desirable] is only the purpose as instantiation, it should not be interpreted as what restricts the range of this invention, but the range of this invention is appropriately described by only the attached claim.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention relates to use of the extended media-access-control function to use at least two signal level thresholds for a detail, about a wireless data telecommunication system.

[0002]

[Background of the Invention] Current marketing of the wireless local area network is

developed and carried out in order to avoid the need for the cable cable splicing between the stations of a local area network (Local Area Network:LAN). Such a wireless local area network uses two or more migration network stations which are the data processors (personal computer etc.) which have radio capacity.

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[0005] According to the media-access-control (MAC) method, if each local-area network station judges that other stations have not transmitted signal transmission, it will start transmission. For this reason, each station postpones transmission of a signal, as long as it is higher than the receiving threshold level as which the signal level received from other stations was specified. That is, it prevents that a media-access-control (MAC) method starts the signal transmission in which the 2nd game which separates from the 1st game and is located overlaps the transmission started by the 1st game before and a time amount target. Usually, the 2nd game postpones the period signal transmission chosen at random.

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[0007] Furthermore, the media access control (Medium Access Control:MAC) explained by IEEE802.11 specification needs one signal threshold level to the two modes, reception and adjournment. The minimum level of a receiving threshold is also the level used for adjournment. Therefore, a receiver suspends transmission, when exceeding a receiving threshold and detecting the signal of an and also [it is of some kind]. IEEE802.11 DSSS Specification is [at -70dBm, the transmitted power 50, or 100mW] equal to -80dBm with less than 50mW of transmitted power -76dBm and 100mW of transmitted power, and 1W, or specifies from it the adjournment threshold which must be high sensitivity.

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[0010] Therefore, in consideration of receiving well by the low, the improved need for medium access equipment of offering common channel medium reuse high enough and power consumption low enough exists.

[0011]

[Summary of the Invention] This invention offers the media-access-control (MAC) method each station of whose in a local area network improved by using two variable parameters. One parameter is called the Carrier Detect threshold for receiving a desirable signal. A Carrier Detect threshold is the level of the carrier signal with which a network station does not tend to deal with a data signal and which is observed in a value lower than it. For example, by changing a Carrier Detect threshold, if it is exceeded, a signal is able to choose the signal level received and processed. The 2nd parameter is called an adjournment threshold. An adjournment threshold is the level of the carrier signal with which a network station postpones transmission of a data signal and which is observed, when it is exceeded.

[0012] Since according to one example of this invention an adjournment threshold is constituted so that it may become high sensitivity from a Carrier Detect threshold, all the stations that wish transmission of a data signal postpone signal transmission, as long as there are other network stations or access points which transmit a data signal. The required prehension ratio for the desirable cell size of a wireless local area network and good reception is a part of parameter which determines the parameter of a Carrier Detect threshold and an adjournment threshold. A medium reuse becomes good, so that the sensibility of an adjournment threshold is low. The capacity which covers a long distance by low traffic reinforcement is combinable with optimization of a set network throughput by choosing suitable adjournment and a Carrier Detect threshold by this approach.

[0013] desirable -- being alike -- according to one example of this invention, the same adjournment threshold is used about all stations including the access point where the cel range corresponds.

[0014] However, since a Carrier Detect threshold is alternatively changed about each station, please understand an advantageous thing. if another word is carried out and a Carrier Detect threshold will be high sensitivity — a transmitter-receiver chip — a Carrier Detect threshold — low — it will process more frequently than the case, sensibility. Since the low sensibility Carrier Detect threshold is taking into consideration reduction of the power consumption of a dc-battery, it is advantageous, but this is important for the migration network station which operates with a dc-battery so that clearly [those who became skillful in this work technical field].

[0015] Although this invention is explained below, referring to an attached drawing, this is only a thing as mere instantiation.

[0016]

[Detailed description of invention] Reference of drawing 2 shows the desirable example of the wireless local area network (LAN) 10 by which this invention is realized. The access point 12 which functions as having explained above as a base station is included in a local area network 10. However, this invention is not restricted at this point and can use the local area network using the server office which sends and receives a message to a network station of other classes. An access point 12 is connected with other equipments and/or network where the network station in LAN10 can communicate. In an access point 12, the antenna 16 constituted so that a communication channel might be led and a data signal might be transmitted and received is contained.

[0017] The mobile station 18-1 which has an antenna 20 respectively, and a migration network station 18 called 18-2 are contained in a network 10 again. Although a direct sequence diffuse-spectrum (DSSS) modulation can be used for a mobile station and a message can be alternatively transmitted and received by 1 Mbit/s (megabits per second) or 2 Mbit/s, this invention is not restricted to that range at this point. The Carrier Detect threshold circuit 70 and the adjournment threshold circuit 72 which can receive a signal via an antenna 20 are included in each mobile station 18. Memory 74 is constituted so that come, it may be [it may expect a Carrier Detect threshold parameter and a total,] and the numeric value of a value parameter may be saved. The output port of memory 74 is combined with the input port of the Carrier Detect threshold circuit 70. Similarly, another output port of memory 74 is combined with the input port of the adjournment threshold circuit 72. That is, memory 74 provides the Carrier Detect threshold circuit 70 corresponding to a desirable Carrier Detect threshold parameter with a signal. Memory 74 provides the desirable adjournment threshold circuit 72 corresponding to [postpone and come, are and] a value parameter with a signal similarly.

[0018] The digital disposal circuit 76 constituted so that the signal received by the antenna 20 might be processed further is contained in the migration network station 18. A digital disposal circuit 76 also processes the signal transmitted by the migration network station with an antenna 20 again. The input port of a digital disposal circuit 76 is constituted so that a detection indication signal may be received from the output port of the Carrier Detect threshold circuit 70. Similarly, another input port of a digital disposal circuit 76 is constituted so that an adjournment indication signal may be

received from the output port of the adjournment threshold circuit 72. Since the output port of a digital disposal circuit 76 is combined with the input port of memory 74, it can postpone with the Carrier Detect threshold parameter saved in memory 74, and can be [can come,], and the numeric value of a value parameter can be changed.

[0019] According to one example of this invention, although each migration network station 18 receives a data signal with the time-slot base between the signal receive modes, this invention is not restricted to that range at this point. A Carrier Detect threshold circuit and an adjournment threshold circuit judge the energy level of a terminating signal during the time-slot period of 20 microseconds. The Carrier Detect threshold circuit 70 supervises the incoming-data signal received by the antenna 20. If the carrier signal exceeding a Carrier Detect threshold parameter of an energy level is detected, the Carrier Detect threshold circuit 70 will provide a digital disposal circuit 76 with a detection indication signal. Answering it, a digital disposal circuit 76 starts processing of the signal received by the antenna 20. Also when the energy level of the received signal postpones, comes and is and exceeds a value parameter, the adjournment threshold circuit 72 provides a digital disposal circuit 76 with the adjournment indication signal which tells a migration network station about the ability not to transmit, in order to avoid the collision on the communication channel used by the local area network 10.

[0020] Reference of drawing 3 shows the situation of the isolated cel from a viewpoint of an access point 12. The carrier signal level observed by the migration network station which separates from an access point 12 and is located is shown by the curve 29 as a function of the distance of the network station from an access point. A curve 29 is determined by the path loss property of the transmitted power used in an access point, and this environment. The capacity of the receiver of the station in the isolated cel is determined by Carrier Detect threshold like the Carrier Detect threshold shown by a straight line 32-1 or 32-2. As reference was made before, a Carrier Detect threshold level is defined by the value lower than it as the LAN station 18-1 and carrier signal level to which 18-2 does not process an incoming-data signal. The Carrier Detect threshold level 32-2 is distance so that it may be illustrated. - Intersecting a curve 29 by R2 and +R2, the Carrier Detect threshold level 32-1 is distance. - A curve 29 is intersected by R and +R. The distance to which the straight line of a Carrier Detect threshold level intersects the curve of carrier signal level determines the boundary of a local area network cel where a migration network station can communicate with an access point 12.

[0021] If the Carrier Detect threshold 32-1 becomes high sensitivity more lower so that clearly, actuation and reception in the larger range will be attained. The cel produced as a result of using the Carrier Detect threshold level 32-1 is shown as a cel 28. The cel which similarly is produced as a result of using the Carrier Detect threshold 32-2 is shown as a cel 30. The network station which operates with the Carrier Detect threshold 32-2 is understood that sensibility is lower than the network station which operates by the Carrier Detect threshold level 32-1.

[0022] A range of number significant for a Carrier Detect threshold level has a low boundary rather than it is determined by the sensibility of a receiving circuit. For example, if a Carrier Detect threshold is set as a low numeric value, the attempt of much meaningless reception will be performed and it will conclude in the high rate of failure on parenchyma. more — low — by using a sensibility Carrier Detect threshold parameter, a local-area network-of-network office can operate within smaller cell size. in case such small cell size takes the possibility of the reuse of the same channel into consideration in the comparatively small range, it is desirable — it comes out. On the contrary, in a lower high sensitivity Carrier Detect threshold level, it can operate in the larger range.

[0023] Reference of drawing 4 shows the relation with a desirable Carrier Detect threshold level shown according to one example of this invention as the adjournment threshold level shown as a straight line 38, and a straight line 32-2. Although the situation that an adjournment threshold is set as level lower (high sensitivity) than a Carrier Detect threshold is shown by drawing 4 , this invention is not restricted to that range at this point. For example, according to other examples of this invention, a Carrier Detect threshold and an adjournment threshold may be changed so that they may attain the same level on parenchyma or a Carrier Detect threshold may become lower than an adjournment threshold.

[0024] According to one example of this invention, in order to determine the adjournment threshold to a predetermined Carrier Detect threshold, it must be taken up in distance R2 and the curve 33 corresponding to the carrier signal power must be plotted for an office called 40 of one side face of a cel as a function of the distance from an office 40. That is, a curve 33 shows the graph of level which is too called a carrier signal curve and with which the carrier signal received from the station 40 as a function of distance was observed. In the case of this example of this invention (+R2 [for example,]), the level which a curve 33 intersects on another side face of a cel defines the adjournment threshold level identified as a straight line 38.

[0025] Therefore, when there is transmission from an access point 12, the level which which station of the range of gray answers is over the Carrier Detect threshold level

32-2. That is, all stations only receive what is transmitted in a circle or cell size 30. However, if the level is exceeded, the level of the carrier signal with which each station postpones transmission and which is observed will be set up by the adjournment threshold level 38.

[0026] the media-access-control equipment shown by drawing 4 — being the so-called -- hiding — terminal problem (hidden terminal problem) It removes on parenchyma. It hides, and a terminal problem is generated when two terminals which cannot be observed transmit a message to the 3rd terminal like an access point at coincidence. At this 3rd terminal like an access point 12, two signals interfere mutually and common channel interference is generated. As for the 3rd terminal, receiving one of the two messages loses two messages at the sacrifice of as hard as possible and precious bandwidth in many cases.

[0027] However, if the media-access-control equipment of drawing 4 is used, the office in one periphery of a cel will be postponed for the office of another most distant periphery of a cel. As explained above, this plots the curve about one periphery station, and when making it adjournment level certainly intersect this curve in other cel peripheries, it is attained. By choosing this level, all stations wait for and postpone each other, and the local area network to which each station communicates with an access point 12 is offered. Consequently, it hides in the group of the station belonging to a cel, and a terminal problem is removed on parenchyma.

[0028] The range of an adjournment threshold has the low boundary determined with the sensibility of a Carrier Detect circuit. When lower than a certain level, a signal is not detected and adjournment is not performed. The desirable relation shown in drawing 4 cannot be attained when set as the lowest high sensitivity level in which the Carrier Detect threshold 32-2 is possible. In this case, the lowest significant adjournment threshold does not guarantee the required adjournment between two "a periphery and offices" as shown in drawing 5 .

[0029] Selection of the numeric value of a low Carrier Detect threshold forms the big cell size of a radius R34, as shown in drawing 5 . When the lowest significant adjournment is plotted, the range which mutual adjournment generates has the small size shown in the small circle which has a radius R36. If this combination of a threshold is used, a network station can hide using the channel access equipment called a Request to Send / ready-for-sending (RTS/CTS) medium reservation device, and can avoid an office phenomenon on parenchyma. Apply this channel access equipment to the publication of this specification by citation. R. O.La Maire, A.Krishna, and P.Bhagwat, J. — Panian — "— wireless LAN and migration networking: — specification and future direction (Wireless LANs and Mobile Networking:Standards and Future Direction)" — It is explained more to the detail by (the U.S. electrical-and-electric-equipment Institute of Electronics and Communication Engineers communication link magazine (IEEE Communication Magazine), Vol.34, No.8 (August, 1996), the 86th page, or the 94th page).

[0030] Reference of drawing 5 calls the sum total cel range 60 the basic coverage range (Basic Coverage Area:BCA). When this vocabulary is used, the range 62 of the smaller one is called the common coverage range (Shared Coverage Area:SCA), and it is shown in this range that the medium common regulation by this invention is effective. With desirable equipment, the common coverage range SCA is almost equal to the basic coverage range BCA.

[0031] When forming the cellular infrastructure system which has the threshold which the above for control of a low receiver and a transmitter defined, it is clear to those who became skillful in this work technical field that suitable balance with a roaming threshold should be maintained so that it may discuss below. When opting for transmission/receiving behavior of the station and access point where the Carrier Detect threshold 32-2 and the adjournment threshold 38 belong to the same cel, a roaming threshold level determines the moment a migration network station opts for initiation or a halt of the participation to a cel. A network station should care about setting capacity of the receiver by which a current setup was carried out as the foundation of the hand-over decision. That is, when small cell size is required, a roaming threshold must be set up so that retrieval of a new access point may be started before the time of it becoming impossible physically for a receiver to receive a message from the present access point.

[0032] Furthermore, according to the principle of this invention, it is possible to define the variable cell size which leads to the capacity which controls the consistency of the cel which covers a certain range directly, or an access point. If it pulls, it means a better sum total throughput from that of the same channel that many small cels are in a certain range as many reuses, rather than there is a small number of big cel.

[0033] In order to set up a Carrier Detect threshold and an adjournment threshold, according to this invention, by using an adjustable threshold, it is possible to reduce cell size and to increase the reuse of the same frequency in a certain range. One approach which reduces cell size is reducing the transmitted power of each access point. Since another approach raises the layer of Carrier Detect and an adjournment threshold according to the example as instantiation of this invention discussed above, it is advantageous. That is, each station disregards the signal of the cel range and

tries most for it in order that it may be cautious of the signal for each stations. Furthermore, since cell size is small, if it gets to know that the purpose receiver is within the limits of a small cel, each station will be tried so that a signal may be transmitted without postponing.

[0034] This invention is realized in the condition machine of a MAC control unit. A condition machine transmitter-receiver is used, and when the effective modem carrier signal of the receiving level exceeding a Carrier Detect threshold is detected, a transmitter-receiver considers that this is an effective modem carrier signal, and starts reception. When the receiving level of an effective modem signal exceeds an adjournment threshold, a transmitter-receiver reports that a medium is using it to a MAC control unit by activating a control line signal.

[0035] The example explained here [a desirable example and here / desirable] is only the purpose as instantiation, it should not be interpreted as what restricts the range of this invention, but the range of this invention is appropriately described by only the attached claim.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the plot of the timing chart showing actuation of carrier Chita pile access of the conventional technique by the collision-avoidance method.

[Drawing 2] It is the block diagram of the wireless local area network containing one access point and two migration network stations by one example of this invention.

[Drawing 3] It is drawing of a plot showing the power observed by the network station as a function of distance when the corresponding access point by one example of this invention transmits a signal, and the effect of the Carrier Detect threshold level as two instantiation to the size of a local area network cel.

[Drawing 4] It is drawing of a plot showing the relation of the adjournment threshold and Carrier Detect threshold about a wireless local area network by one example of this invention.

[Drawing 5] It is drawing of a plot by one example of this invention showing the effect of increase of the sensibility of a Carrier Detect threshold.

[Translation done.]

* NOTICES *

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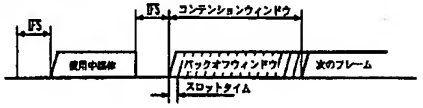
1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

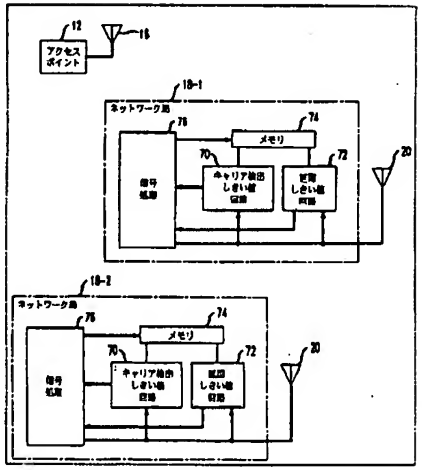
3.In the drawings, any words are not translated.

DRAWINGS

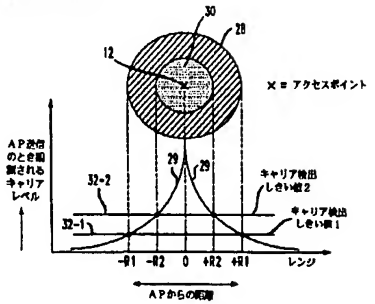
[Drawing 1]



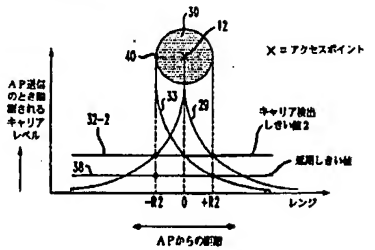
[Drawing 2]



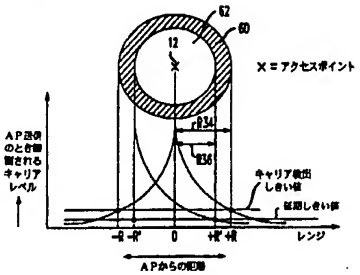
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]

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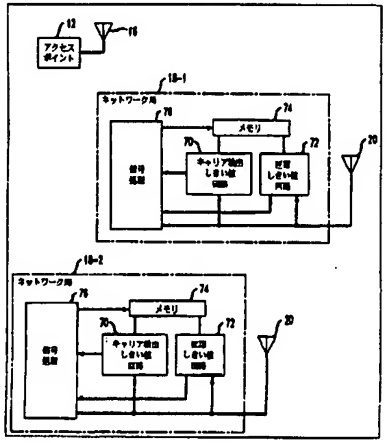
最終頁に続く

(54)【発明の名称】 キャリア検知を向上させた無線ローカルエリア・ネットワーク

(57)【要約】

【課題】 本発明は、少なくとも2つの信号レベルしきい値を利用する拡張媒体アクセス制御機能の利用に関し、より詳細には、低レベルでうまく受信することを考慮し、十分に高い共通チャネル媒体再利用と十分に低い電力消費を提供する改善された媒体アクセス装置を提供することを目的とする。

【解決手段】 無線ローカルエリア・ネットワーク局を動作させる本発明は、キャリア検出しきい値レベルを確立する段階と、延期しきい値レベルを確立する段階と、対応する電力信号レベルを有するキャリア信号を受信する段階と、該電力信号レベルが該延期しきい値より低いときには信号を送信する段階と、該電力信号レベルが該第1キャリア検出しきい値レベルより高いときには該ネットワーク局向けの該キャリア信号を処理する段階とからなることを特徴とする。



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【特許請求の範囲】

【請求項1】 無線ローカルエリア・ネットワーク局を動作させる方法であって、該方法は、

キャリア検出しきい値レベルを確立する段階と、

延期しきい値レベルを確立する段階と、

対応する電力信号レベルを有するキャリア信号を受信する段階と、

該電力信号レベルが該延期しきい値より低いときには信号を送信する段階と、

該電力信号レベルが該第1キャリア検出しきい値レベルより高いときには該ネットワーク局向けの該キャリア信号を処理する段階とからなることを特徴とする方法。

【請求項2】 請求項1に記載の方法において、該方法はさらに、該キャリア検出しきい値レベルと該延期しきい値レベルを変化させる段階からなることを特徴とする方法。

【請求項3】 請求項1に記載の方法において、該方法はさらに、該キャリア検出しきい値レベルを該延期しきい値レベルより高いレベルに確立する段階からなることを特徴とする方法。

【請求項4】 請求項1に記載の方法において、該方法はさらに、該キャリア検出しきい値レベルを該延期しきい値レベルとほぼ等しいレベルに確立する段階からなることを特徴とする方法。

【請求項5】 請求項1に記載の方法において、該方法はさらに、該キャリア検出しきい値を該延期しきい値レベルより低いレベルに確立する段階からなることを特徴とする方法。

【請求項6】 請求項1に記載の方法において、該方法はさらに、内部で複数の移動ネットワーク局が所定の基地局と通信する通信セルを定義するように、キャリア検出しきい値信号レベルを選択する段階からなることを特徴とする方法。

【請求項7】 請求項6に記載の方法において、該延期しきい値レベルを確立する段階は、ほぼ該通信セルの反対側に位置する距離で該通信セルの1つの周縁に位置する局の電力－距離曲線に沿った電力レベルにほぼ等しくなるように延期しきい値信号レベルを確立する段階からなることを特徴とする方法。

【請求項8】 請求項1に記載の方法において、該通信セルのサイズが該キャリア検出しきい値と該延期しきい値の関数であることを特徴とする方法。

【請求項9】 通信セル内で信号を送信及び受信できる無線ローカルエリア・ネットワーク局であって、該ネットワーク局は、

電力信号レベルを有するキャリア信号を受信するよう構成されたキャリア検出しきい値回路からなり、該キャリア検出しきい値回路は、該電力信号レベルが指定されたキャリア検出しきい値パラメータとほぼ等しいかそれより大きい場合検出指示信号を発生するものであり、該ネットワーク局はさらに、

該電力信号レベルを有する該キャリア信号を受信するよう構成された延期しきい値回路からなり、該延期しきい値回路は、該電力信号レベルが指定された延期しきい値パラメータとほぼ等しいかそれより大きい場合延期指示信号を発生するものであり、該ネットワーク局はさらに、

該キャリア検出回路と該延期しきい値回路に結合された信号処理回路とからなり、該信号処理回路が該キャリア検出指示信号に応答して該ネットワーク局によって受信された信号を処理し、該信号処理回路が該延期指示信号に応答して該ネットワーク局による信号の送信を延期するように、該キャリア検出指示信号と該延期指示信号を受信することを特徴とする無線ローカルエリア・ネットワーク局。

【請求項10】 請求項9に記載のネットワーク局において、該キャリア検出しきい値レベルと該延期しきい値レベルが可変であることを特徴とするネットワーク局。

【請求項11】 請求項10に記載のネットワーク局において、該キャリア検出しきい値レベルが該延期しきい値レベルより高いことを特徴とするネットワーク局。

【請求項12】 請求項10に記載のネットワーク局において、該キャリア検出しきい値レベルが該延期しきい値レベルにほぼ等しいことを特徴とするネットワーク局。

【請求項13】 請求項10に記載のネットワーク局において、該キャリア検出しきい値レベルが該延期しきい値レベルより低いことを特徴とするネットワーク局。

【請求項14】 請求項9に記載のネットワーク局において、該延期しきい値レベルが、ほぼ該通信セルの反対側に位置する距離で該通信セルの1つの周縁に位置する局の電力／距離曲線に沿った電力レベルにほぼ等しいことを特徴とするネットワーク局。

【請求項15】 請求項9に記載のネットワーク局において、該通信セルのサイズが該キャリア検出しきい値と該延期しきい値の関数であることを特徴とするネットワーク局。

【発明の詳細な説明】

【0001】

【発明の分野】本発明は、無線データ通信システムに関し、詳細には、少なくとも2つの信号レベルしきい値を利用する拡張媒体アクセス制御機能の利用に関する。

【0002】

【発明の背景】ローカルエリア・ネットワーク（Local Area Network：LAN）の局間の有線ケーブル接続の必要を回避する目的で、無線ローカルエリア・ネットワークが開発され、現在市販されている。こうした無線ローカルエリア・ネットワークは、無線通信能力を有するデータ処理装置（パソコン等）である複数の移動ネットワーク局を利用する。

3

【０００３】有線によるネットワークでは、衝突検出を比較的容易に達成することができる。しかし、１つのチャネルを使用する無線によるネットワークの場合、受信信号レベルのダイナミック・レンジが広いため、衝突を検出することがかなり困難である。従って、無線ローカルエリア・ネットワークは、通常、衝突検出の代わりに衝突回避スキームを利用する。

【０００４】無線ローカルエリア・ネットワーク（ＬＡＮ）は、一般に、IEEE802.11規格によって説明されているＣＳＭＡ／ＣＡ（衝突回避を伴うキャリア検知多重アクセス）のような「話す前に聞く(listen-before-talk)」スキームを利用する媒体アクセス制御（ＭＡＣ）方式に基づいて構成されている。IEEE802.11規格で説明される１つの実施例によれば、無線ローカルエリア・ネットワークには、基地局として機能するアクセスポイントと、複数の他のネットワーク局が含まれる。グループまたはセル内のネットワーク局は直接それらの対応するアクセスポイントと通信する。このアクセスポイントはメッセージを、同じセル内の宛先局に転送するか、または有線分配システムを通じて他のアクセスポイントに転送し、そこからメッセージが最終的に望ましい宛先局に転送される。

【０００５】媒体アクセス制御（ＭＡＣ）方式によれば、各ローカルエリア・ネットワーク局は、他の局が通信信号を送信していないと判断すると送信を開始する。このため、各局は、他の局から受信する信号レベルが指定された受信しきい値レベルより高い限り信号の送信を延期する。すなわち、媒体アクセス制御（ＭＡＣ）方式は、第１局から離れて位置する第２局が、第１局によって以前に開始された送信と時間的に重なり合う信号送信を開始することを防止する。通常、第２局はランダムに選択された期間信号送信を延期する。

【０００６】非常に短い期間のキャリア検出ターンアラウンド・タイム(carrier dtectiontunaround time)がこのランダム待機特性にとって基本的である。例えば、IEEE802.11 DSSS（Direct Sequence Spread Spectrum：ＤＳＳＳ（直接シーケンス拡散スペクトル））規格は、キャリア検出ターンアラウンド・タイムを対象とする、２０μ秒（マイクロ秒）タイムスロットに基づいたスロット化ランダム待機挙動を必要とする。

【０００７】さらに、IEEE802.11規格によって説明される媒体アクセス制御（Medium Access Control：ＭＡＣ）は、受信及び延期の２つのモードに対して１つの信号しきい値レベルを必要とする。受信しきい値の最低レベルは延期のために使用されるレベルでもある。従って、受信機は、受信しきい値を超える何らかの他の信号を検出する場合、送信を停止する。IEEE802.11 DSSS 規格は、送信電力５０ｍＷ未満で－７０ｄＢｍ、送信電力５０乃至１００ｍＷで－７６ｄＢｍ、及び送信電力１００ｍＷ乃至１Ｗで－８０ｄＢｍに等しいかそれより高感度でなければならない延期しきい値を指定する。

4

【０００８】図１を参照すると、衝突回避を提供する従来技術の方法が示され説明される。すなわち、IEEE802.11 CSMA／ＣＡプロトコルが、最も発生しやすい地点で媒体にアクセスする多数の局間の衝突可能性を低減するよう設計される。媒体の使用中に続いて、媒体が空き状態になった直後の時点で衝突の可能性が最も高くなる。これは多数の局が媒体が再び利用可能になるのを待っていたためである。従って、媒体の回線争奪競合を解決するためランダム・バックオフ方式が使用される。当業技術分野に熟練した者には明らかなように、このランダム待機特性にとって、超短期間キャリア検出ターンアラウンド・タイムが基本的である。さらに、IEEE802.11媒体アクセス制御（ＭＡＣ）は、ＲＴＳ／ＣＴＳ（Rrequest-To-Sender ／Clear-To-Send：送信要求／送信可）ポーリング対話と時間限定サービスの点座標によって媒体予約に関するオプションを定義する。図１に示すように、媒体使用中期間の後、すべての無線ＬＡＮ装置はいわゆるフレーム間間隔（Inter Frame Spacing：ＩＦＳ）期間の間待機しなければならず、その後他の送信がない限り必要なランダムな数のスロット時間待機した後送信を試みることができる。

【０００９】共通チャネル媒体の再使用に関して、IEEE802.11 DSSS 規格は許容可能な捕捉特性を規定するが、これはより低感度な延期しきい値の使用を可能にし、よりよい媒体再利用条件に帰結するものである。しかし、延期しきい値がより低感度になるということは、送信の破損が防止される範囲が小さくなることを意味する。アクセスポイントベースのネットワーク及びサーバ局による臨時ネットワークでは、トラヒックはアクセスポイントまたはサーバ局を出入りする。アクセスポイント／サーバ局とその割当てられた局が互いに受信する最小受信レベルは、マルチパス・フェージングと陰影効果のため、またアクセスポイントからの移動ネットワーク局の距離の変化のために予測困難である。

【００１０】従って、低レベルでうまく受信することを考慮し、十分に高い共通チャネル媒体再利用と十分に低い電力消費を提供する改善された媒体アクセス装置の必要が存在する。

【００１１】

【発明の概要】本発明は、２つの可変パラメータを利用することによって、ローカルエリア・ネットワーク内の各局の向上した媒体アクセス制御（ＭＡＣ）方式を提供する。１つのパラメータは望ましい信号を受信するためのキャリア検出しきい値と呼ばれる。キャリア検出しきい値は、それより低い値ではネットワーク局がデータ信号を処理しようとしない、観測されるキャリア信号のレベルである。例えば、キャリア検出しきい値を変化させることによって、それを超えると信号が受信及び処理される信号レベルを選択することが可能である。第２のパラメータは延期しきい値と呼ばれる。延期しきい値は、それを超えるとネットワーク局がデータ信号の送信を延期する、観測されるキャリア信号のレベルである。

5

【００１２】本発明の１つの実施例によれば、延期しきい値はキャリア検出しきい値より高感度となるよう構成されるので、データ信号の送信を希望するすべての局は、データ信号を送信する他のネットワーク局またはアクセスポイントがある限り信号送信を延期する。無線ローカルエリア・ネットワークの望ましいセル・サイズと良好な受信のための必要な捕捉比は、キャリア検出しきい値と延期しきい値のパラメータを決定するパラメータの一部である。延期しきい値の感度が低いほど、媒体再使用が良好になる。この方法で、適当な延期及びキャリア検出しきい値を選択することによって、集合ネットワーク・スループットの最適化と、低いトラヒック強度で長距離をカバーする能力を結合することができる。

【００１３】好ましいには、本発明の１つの実施例によれば、同じ延期しきい値が、セル範囲の対応するアクセスポイントを含むすべての局について利用される。

【００１４】しかし、キャリア検出しきい値は、各局について選択的に変化させられるので有利であることを理解されたい。別言すれば、キャリア検出しきい値が高感度だと、送受信機チップはキャリア検出しきい値が低感度な場合よりも頻繁に処理を行うことになる。低感度キャリア検出しきい値はバッテリの電力消費の低減を考慮しているので有利であるが、これは当業技術分野に熟練した者に明らかなように、バッテリで動作する移動ネットワーク局にとって重要である。

【００１５】添付の図面を参照しながら、本発明を以下に説明するが、これは単なる例示としてのものにすぎない。

【００１６】

【発明の詳細な記述】図２を参照すると、本発明が実現される無線ローカルエリア・ネットワーク（ＬＡＮ）１０の好ましい実施例が示される。ローカルエリア・ネットワーク１０には、上記で説明したように基地局として機能するアクセスポイント１２が含まれる。しかし、本発明はこの点で制限されるものではなく、ネットワーク局にメッセージを送受するサーバ局を利用する他の種類のローカルエリア・ネットワークを利用することができる。アクセスポイント１２は、ＬＡＮ１０中のネットワーク局が通信することのできる他の装置及び／またはネットワークと接続される。アクセスポイント１２には、通信チャネルを通じてデータ信号を送信及び受信するよう構成されたアンテナ１６が含まれる。

【００１７】ネットワーク１０にはまた、各々アンテナ２０を有する移動局１８－１、１８－２といった移動ネットワーク局１８が含まれる。移動局は、直接シーケンス拡散スペクトル（ＤＳＳＳ）変調を使用して１Ｍｂｉｔ／ｓ（メガビット／秒）または２Ｍｂｉｔ／ｓで選択的にメッセージを送信及び受信することができるが、本発明はこの点でその範囲に制限されるものではない。各移動局１８には、アンテナ２０を経由して信号を受信することのできるキャリア検出しきい値回路７０及び延期しきい値回路７２が含まれる。メモリ７４はキャリア検出しきい値パラメータ及び延期しきい値パラメータの数値を保存するよう構成されている。メモリ７４の出力ポートがキャリア検出しきい値回路７０の入力ポートに結合される。同様に、メモリ７４のもう１つの出力ポートが延期しきい値回路７２の入力ポートに結合される。すなわちメモリ７４は、信号を望ましいキャリア検出しきい値パラメータに対応するキャリア検出しきい値回路７０に提供する。同様にメモリ７４は、信号を望ましい延期しきい値パラメータに対応する延期しきい値回路７２に提供する。

【００１８】移動ネットワーク局１８には、さらに、アンテナ２０によって受信された信号を処理するよう構成された信号処理回路７６が含まれる。信号処理回路７６はまた、アンテナ２０によって移動ネットワーク局によって送信される信号も処理する。信号処理回路７６の入力ポートは、キャリア検出しきい値回路７０の出力ポートから検出指示信号を受信するよう構成されている。同様に、信号処理回路７６のもう１つの入力ポートは、延期しきい値回路７２の出力ポートから延期指示信号を受信するよう構成されている。信号処理回路７６の出力ポートはメモリ７４の入力ポートに結合されているので、メモリ７４に保存されるキャリア検出しきい値パラメータと延期しきい値パラメータの数値を変化させることができる。

【００１９】本発明の１つの実施例によれば、各移動ネットワーク局１８は、信号受信モードの間にタイムスロット・ベースでデータ信号を受信するが、本発明はこの点でその範囲に制限されるものではない。２０μｓといったタイムスロット期間中、キャリア検出しきい値回路と延期しきい値回路は着信信号のエネルギー・レベルを判定する。キャリア検出しきい値回路７０はアンテナ２０によって受信された着信データ信号を監視する。キャリア検出しきい値パラメータを超えるエネルギー・レベルのキャリア信号が検出されると、キャリア検出しきい値回路７０は検出指示信号を信号処理回路７６に提供する。それに応答して信号処理回路７６はアンテナ２０によって受信された信号の処理を開始する。受信された信号のエネルギー・レベルが延期しきい値パラメータを超える場合も、延期しきい値回路７２は、ローカルエリア・ネットワーク１０によって利用される通信チャネル上の衝突を回避するために、送信を行うことができないことを移動ネットワーク局に知らせる延期指示信号を信号処理回路７６に提供する。

【００２０】図３を参照すると、孤立したセルの状況がアクセスポイント１２の観点から示される。アクセスポ

イント１２から離れて位置する移動ネットワーク局によって観測されるキャリア信号レベルが、アクセスポイントからのネットワーク局の距離の関数として曲線２９によって示される。曲線２９は、アクセスポイントで使用される送信電力とこの環境の経路損失特性によって決定される。孤立したセル内の局の受信機の能力は、直線３２－１または３２－２によって示されるキャリア検出しきい値のようなキャリア検出しきい値によって決定される。前に言及したように、キャリア検出しきい値レベルは、それより低い値ではＬＡＮ局１８－１、１８－２が着信データ信号を処理しないキャリア信号レベルとして定義される。例示されるように、キャリア検出しきい値レベル３２－２は、距離－Ｒ２及び＋Ｒ２で曲線２９と交差し、キャリア検出しきい値レベル３２－１は、距離－Ｒ及び＋Ｒで曲線２９と交差する。キャリア検出しきい値レベルの直線がキャリア信号レベルの曲線と交差する距離が、移動ネットワーク局がアクセスポイント１２と通信できるローカルエリア・ネットワーク・セルの境界を決定する。

【００２１】明らかなように、キャリア検出しきい値３２－１がより低くより高感度になると、より広い範囲での動作と受信が達成される。キャリア検出しきい値レベル３２－１を利用する結果生じるセルがセル２８として示される。同様に、キャリア検出しきい値３２－２を利用する結果生じるセルがセル３０として示される。キャリア検出しきい値３２－２で動作するネットワーク局は、キャリア検出しきい値レベル３２－１で動作するネットワーク局より感度が低いことがわかる。

【００２２】キャリア検出しきい値レベルにとって有意な数値の範囲は受信回路の感度によって決定されるより低い境界を有する。例えば、キャリア検出しきい値を低い数値に設定すると、多数の無意味な受信の試みが行われ、実質上高い失敗率に帰結する。より低感度なキャリア検出しきい値パラメータを利用することによって、ローカルエリア・ネットワークのネットワーク局はより小さいセル・サイズ内で動作することができる。こうした小さいセル・サイズは、比較的小さい範囲で同じチャネルの再使用の可能性を考慮する際、好ましいである。逆に、より低い、より高感度なキャリア検出しきい値レベルでは、より広い範囲で動作することができる。

【００２３】図４を参照すると、本発明の１つの実施例によって、直線３８として示される延期しきい値レベルと直線３２－２として示されるキャリア検出しきい値レベルの好ましいな関係が示される。図４では、延期しきい値がキャリア検出しきい値より低い（より高感度な）レベルに設定される状況が示されるが、本発明はこの点でその範囲に制限されるものではない。例えば、本発明の他の実施例によれば、キャリア検出しきい値と延期しきい値は、それらが実質上同じレベルを達成するか、またはキャリア検出しきい値が延期しきい値より低くなるように変更されることがある。

【００２４】本発明の１つの実施例によれば、所定のキャリア検出しきい値に対する延期しきい値を決定するために、セルの１つの側面の４０といった局が、例えば、距離Ｒ２で取り上げられ、そのキャリア信号電力に対応する曲線３３が局４０からの距離の関数としてプロットされなければならない。すなわち、曲線３３は、やはりキャリア信号曲線と呼ばれる、距離の関数として局４０から受信されたキャリア信号の観測されたレベルのグラフを示す。本発明のこの実施例の場合、例えば、＋Ｒ２で、曲線３３がセルの別の側面で交差するレベルは、直線３８として識別される延期しきい値レベルを定義する。

【００２５】従って、アクセスポイント１２からの送信がある場合、灰色の範囲の何れかの局が応答するレベルはキャリア検出しきい値レベル３２－２を超えている。すなわち、すべての局は、円またはセル・サイズ３０の中で送信されるものを受信するだけである。しかし、そのレベルを超えると、各局が送信を延期する観測されるキャリア信号のレベルが延期しきい値レベル３８で設定される。

【００２６】図４で示される媒体アクセス制御装置は、いわゆる隠れ端末問題(hidden terminal problem)を実質上除去する。隠れ端末問題は、互いに観測できない２つの端末が同時にアクセスポイントのような第３の端末にメッセージを送信する場合に発生する。アクセスポイント１２のようなこの第３の端末では、２つの信号が互いに干渉し共通チャネル干渉を発生する。第３の端末は２つのメッセージの１つを受信するのが精一杯であり、貴重な帯域幅を犠牲にして２つのメッセージを失うことも多い。

【００２７】しかし、図４の媒体アクセス制御装置を使用すると、セルの１つの周縁にある局は、セルの最も遠い別の周縁の局のために延期する。これは、前に説明したように、１つの周縁局に関する曲線をプロットし、延期レベルが確実に他のセル周縁でこの曲線と交差するようにすることによって達成される。このレベルを選択することによって、すべての局が互いを待って延期し、各局がアクセスポイント１２と通信するローカルエリア・ネットワークが提供される。その結果、セルに属する局のグループ内の隠れ端末問題は実質上除去される。

【００２８】延期しきい値の範囲は、キャリア検出回路の感度によって決定される低い境界を有する。あるレベルより低い場合、信号は検出されず延期は行われない。図４に示す好ましいな関係は、キャリア検出しきい値３２－２が可能な最も低く最も高感度なレベルに設定されている場合、達成することができない。この場合、最も低い有意な延期しきい値は、図５に示すような２つの「周縁局」間の必要な延期を保証しない。

【００２９】低いキャリア検出しきい値の数値を選択すると、図５に示すように、半径Ｒ３４の大きなセル・サイズが形成される。最も低い有意な延期をプロットすると、相互延期が発生する範囲は、半径Ｒ３６を有する小さな円の中に示される小さなサイズを有する。しきい値のこの組み合わせを利用すると、ネットワーク局は送信要求／送信可（ＲＴＳ／ＣＴＳ）媒体予約機構と呼ばれるチャネル・アクセス装置を利用して隠れ局現象を実質上回避することができる。このチャネル・アクセス装置は、引用によって本明細書の記載に援用する、R.O.La Maire、A.Krishna、及びP.Bhagwat、J.Panianの「無線ＬＡＮと移動ネットワーキング：規格と将来の方向(Wireless LANs and Mobile Networking：Standards and Future Direction)」（米国電気電子通信学会通信雑誌(IEEE Communication Magazine)、Vol.34、No.8（１９９６年８月）、第８６頁乃至第９４頁）でより詳細に説明されている。

【００３０】図５を参照すると、合計セル範囲６０は基本カバレージ範囲（Basic Coverage Area：ＢＣＡ）と呼ばれる。この用語を使用すると、小さい方の範囲６２は共用カバレージ範囲（Shared Coverage Area：ＳＣＡ）と呼ばれ、この範囲では本発明による媒体共用規則が有効であることを示す。好ましいな装置では、共用カバレージ範囲ＳＣＡは、基本カバレージ範囲ＢＣＡにほぼ等しい。

【００３１】低レベル受信機及び送信機の制御のための上記で定義したしきい値を有するセルラ・インフラストラクチャ・システムを形成する場合、当業技術分野に熟練した者には、以下論じるようにローミングしきい値との適切なバランスを維持すべきであることが明らかである。キャリア検出しきい値３２－２と延期しきい値３８が同じセルに属する局とアクセスポイントの送信／受信挙動を決定する場合、ローミングしきい値レベルは、移動ネットワーク局がセルへの参加の開始または停止を決定する瞬間を決定する。ネットワーク局は、現在設定された受信機の能力をそのハンドオーバー決定の基礎とすることに留意されたい。すなわち、小さなセル・サイズが必要な場合、ローミングしきい値は、受信機が現在のアクセスポイントからメッセージを受信することが物理的に不可能になる時点より前に新しいアクセスポイントの探索を開始するよう設定しなければならない。

【００３２】さらに、本発明の原理によれば、直接ある範囲をカバーするセルまたはアクセスポイントの密度を制御する能力につながる可変セル・サイズを定義することが可能である。ある範囲に多数の小さなセルがあることは、少数の大きなセルがあるよりも同じチャネルのより多くの再使用と、ひいてはよりよい合計スループットを意味する。

【００３３】キャリア検出しきい値及び延期しきい値を設定するために可変しきい値を利用することによって、本発明によれば、セル・サイズを縮小し、ある範囲で同じ周波数の再使用を増大することが可能である。セル・サイズを縮小する１つのアプローチは、各アクセスポイントの送信電力を低下させることである。もう１つのアプローチは、上記で論じた本発明の例示としての実施例によってキャリア検出及び延期しきい値の層を上昇させるので有利である。すなわち、各局はセル範囲の信号を大部分を無視し、各局向けの信号に注意しようと試みる。さらに、各局は、セル・サイズが小さいため、目的受信機が小さなセルの範囲内にあることを知ると、延期しないで信号を送信するよう試みる。

【００３４】本発明はＭＡＣ制御装置の状態マシンにおいて実現される。状態マシン送受信機を利用し、キャリア検出しきい値を超える受信レベルの有効モデム・キャリア信号が検出される場合、送受信機はこれを有効モデム・キャリア信号と見なして受信処理を開始する。有効モデム信号の受信レベルが延期しきい値を超える場合、送受信機は、制御ライン信号をアクティブにすることによって、媒体が使用中であることをＭＡＣ制御装置に報告する。

【００３５】好ましい実施例とここで説明された例は、例示としての目的のみであって、本発明の範囲を制限するものと解釈されるべきではなく、本発明の範囲は添付の請求項によってのみ適切に叙述される。

【図面の簡単な説明】

【図１】衝突回避方式による従来技術のキャリア検知多重アクセスの動作を示すタイミング図のプロットである。

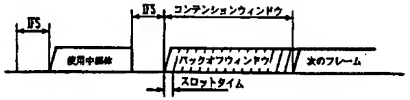
【図２】本発明の１つの実施例による１つのアクセスポイントと２つの移動ネットワーク局を含む無線ローカルエリア・ネットワークのブロック図である。

【図３】本発明の１つの実施例による、対応するアクセスポイントが信号を送信するとき距離の関数としてネットワーク局によって観測される電力と、ローカルエリア・ネットワーク・セルのサイズに対する２つの例示としてのキャリア検出しきい値レベルの影響とを示すプロットの図である。

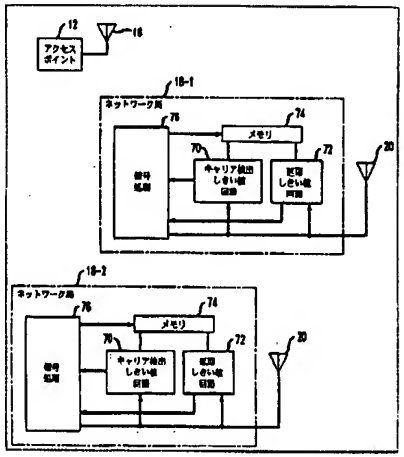
【図４】本発明の１つの実施例による、無線ローカルエリア・ネットワークに関する延期しきい値とキャリア検出しきい値との関係を示すプロットの図である。

【図５】本発明の１つの実施例による、キャリア検出しきい値の感度の増大の影響を示すプロットの図である。

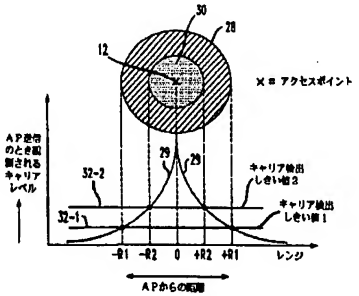
【図1】



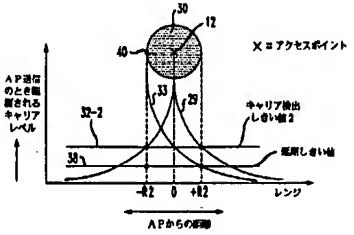
【図2】



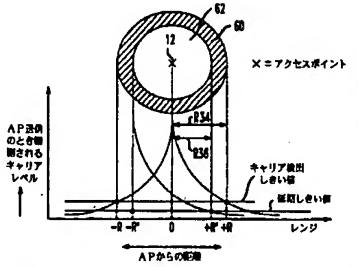
【図3】



【図4】



【図5】



フロントページの続き

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